

FACTORS IMPACTING THE MARKET SHARE OF CONSTRUCTION AND DEMOLITION (C&D) WASTE RECYCLING SOLUTIONS

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Abstract

Current EU Directives force the Member States to assure by 2020 that 70% of the Construction and Demolition (C&D) waste is recovered instead of landfilled. While some countries have largely achieved this target, others still have a long way to go. For better understanding the differences arising from local disparities, six factors related to technical, economic, legislative and environmental aspects have been identified as crucial influences in the market share of C&D waste recycling solutions. These factors are able to identify the causes that limit the recycling rate of a certain region. Moreover, progress towards an efficient waste management can vary through the improvement of a single factor. This study provides the background for further fine-tuning the factors and their combination into a mathematical model for assessing the market share of C&D recycling solutions.

Keywords: Construction and Demolition (C&D) waste, market share, recycling, technical factors, economic factors, legislative factors, environmental factors.

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1 Introduction

To find reliable statistics related to Construction and Demolition (C&D) waste management for the different countries is a difficult task, even more if referred to different fractions or different end routes such as re-use and recycling. As far as recycling is concerned, two different approaches can be followed: separating wastes at the source of generation or sending them mixed up to a sorting facility, choice that depends on whether there is space for on-site sorting, if there are sorting facilities or recycling facilities nearby and among other circumstances, the final decision of the contractor. This simple example involves different possibilities that, combined with other decisions taken throughout the construction, demolition or deconstruction process, together with the characteristics of a specific region or country (economic situation, environmental awareness, etc.) have a direct impact in the amount of C&D waste that is being properly managed.

Through the analysis of literature, different research studies related to factors impacting waste management have been found and are briefly described below:

- Suttibak & Nitivattananon (2008) investigated the factors influencing the performance of solid waste management covering different recycling programs located in several urban areas of Thailand.
- (Lu & Yuan, 2010) aimed to identify the Critical Success Factors (CSFs) for C&D waste management within the context of Shenzhen's construction industry, one of the regions of China. Wan, Shen, & Yu (2014) aimed to establish the relationship between policy effectiveness and recycling behaviour. They perform an in-depth analysis on

one of the major categories impacting market share of C&D waste recycling: legislative.

These studies provide an adequate background for the formulation of this study. However, none of them focus on analyzing the market share of C&D waste recycling solutions from a multi-criteria approach and valid for any country or region.

On these grounds, a new methodology aiming to set the basis for assessing the market share of C&D waste recycling solutions is presented, by means of technical, economic, legislative and environmental factors, enabling to study the causes that may limit the recycling rate in a certain region. This methodology also determines how progress towards a high rate of C&D waste recycling can be achieved through the improvement of a single factor or combination of several factors.

2 Methodological approach

This research provides a set of major factors for analyzing the situation leading to C&D waste recycling instead of landfilling and for any particular region. In order to receive input related to C&D waste management practices of different stakeholders (including recycling centres, public and private landfills owners and waste management companies), surveys and personal interviews were conducted in 8 European countries. The objective was to better understand the differences between countries that are currently experiencing a high rate of C&D waste recycling with those where most of the C&D waste is mixed up and sent to landfill. The results obtained, together with the data collected from the published literature has provided the basis for the formulation of the set of relevant factors here presented.

3 Results and discussion

The crucial factors identified have been grouped in four categories: technical, economic, legislative and environmental. Each of them is described in the following sections.

3.1 Technical factors

3.1.1 Reach of the recycling system (R_{RS})

R_{RS} describes the share of the C&D waste that can be reached by the established recycling system in the market (table 1). It is influenced by the following sub-factors:

- Geographical coverage: representing the presence of recycling facilities in a certain region.
- Recycling waste strategy: may limit RRS if the recycling system is only opened to certain waste fractions or specific manufacturer's waste.

Recycling system existence	Sub-factors	R_{RS} value
No	-	0
Yes	Geographical coverage	$0 < R_{RS} \leq 1$
	Recycling waste strategy	

Table 1. R_{RS} value

3.1.2 Level of segregation of a certain fraction from the rest of C&D waste (S_s)

S_s represents the amount of a certain waste fraction that can be separated from the rest of C&D waste generated (table 2). A certain C&D waste can be separated:

- On site. When source segregation occurs.
- In a transfer station. The waste is transported to the transfer station forming part of C&D mixed wastes. As a consequence, a variable percentage is disintegrated into small pieces difficulting its further segregation.

Segregation	S_s value	
No	-	0
Yes	On site	$0 < S_s \leq 1$
	Transfer station	

Table 2. S_s value

3.2 Economic factor

3.2.1 Competitiveness of the recycling solution compared to local landfills (C_{RS})

C_{RS} is the relative competitiveness of the C&D waste recycling solution in a given country, compared to landfill disposal. Overall the market share will heavily depend on:

- Whether a recycling solution has been established in a given country and,
- How competitive that solution is to the landfills in the market.

3.3 Legislative factors

3.3.1 Level of compliance with the existing regulations (C_0)

This factor describes the share of the total C&D waste market that follows the existing regulations (table 3). The driver for not following regulations is to achieve a lower economic cost for the disposal of the waste.

Compliance with regulations	Level	Co value
No	-	0
Yes	High/Medium/Low	$0 < C_0 \leq 1$

Table 3. Co value

3.3.2 Legal alternative cheaper destinations for the waste (A_S)

A_S is a determining factor that describes the share of C&D waste market for which legal alternative solutions exist, that are cheaper than landfills. If such solutions exist the amount of waste disposed in landfills will be reduced. However, if they are more expensive than landfills they will not be established.

The alternative solutions may be found all over a country or only in certain areas or regions, this fact can also limit the share that is caught by these legal alternative solutions.

3.4 Environmental factor

3.4.1 Environmental focus (E_S)

For a certain share of the C&D waste, other factors will determine where the waste ends up. Thus, there will be a certain amount of the waste owners that will decide to treat waste in the most environmental friendly way no matter the cost, which generally will drive to the recycling solution.

The waste owner may choose to disregard the cost and demand the recycling solution due to general environmental or climate concerns or to requirements from the building owner as a consequence of the wish to obtain certain environmental profile or fulfill the requirements in any existing environmental assessment tool. Thus, E_S describes the share of the C&D waste market, where environmental factors determine the destination of the waste (table 4)

Environmental focus	Level	E_S value
No	-	0
Yes	Low/Medium/High	$0 < E_S \leq 1$

Table 4. E_S value

4 Conclusion

A total of six factors that influence the existence of a market for C&D waste recycling solutions have been identified with the aim of helping to detect the causes that limit the recycling rate of C&D waste in a market and what can be done in order to improve the current situation. Further analysis is needed for determining the range of variation of the

factors, as well as the major sub-factors and procedures for better estimating each value. The combination of these factors into one single equation is being fine-tuned and will allow obtaining an estimation of the market share of C&D waste recycling solutions for a region or country.

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